REMARKS

Preliminary Matters

It appears that the attached Change of Correspondence Address has not been entered into the application. Please enter it into the application.

Claim Amendments

Amended independent claims 1, 46 and 49 now recite that at least a portion of a condensed phase comprising a liquid phase is collected from the flame. This amendment to claims 1, 46 and 49 was suggested by the Examiner in the Office Action. Amended independent claims 1, 46 and 49 also now recite that the liquid phase has not undergone thermolysis and/or dehydrogenation to form mature soot, fullerenes or nanotubes. This amendment has a basis at page 14, lines 12-15 of the specification.

Rejection under 35 USC §102(b)

Claims 1-28, 34-42, 44 and 46-52 were rejected under 35 USC §102(b) as being anticipated by Benish *et al.*, "C_2H_2 and PAH as Soot Growth Reactants In Premixed C_2H_4-Air Flames", 26th Symposium (international) on Combustion, pp 2319-2326, 1996 ("Benish").

Amended independent claims 1, 46 and 49 now recite that the liquid phase has not undergone thermolysis and/or dehydrogenation to form mature soot, fullerenes or nanotubes. This amendment serves to more clearly distinguish the claimed invention from Benish.

Benish samples from a water cooled probe stuck in the flame. This quenches the action of the flame as the sampling takes place. The present claimed method involves collecting the precursor soot as a reactive medium for the formation of

fullerenes and other valuable types of carbon. This is the liquid medium (precursor soot) that exists in the flame or high temperature environment (i.e., the soot "has not undergone thermolysis and/or dehydrogenation to form mature soot, fullerenes or nanotubes" as recited in the amended claims). When precursor soot is pulled out of the high temperature environment as in Benish, it is no longer precursor soot.

The present invention teaches that the reaction medium has to stay hot such that the soot has not undergone thermolysis and/or dehydrogenation to form mature soot, fullerenes or nanotubes. This hot liquid medium is then manipulated to yield the desired products. Benish is essentially using the flame to produce the desired products. The present inventor uses the flame or high temperature environment to produce the precursor soot and then manipulate that to form the desired products. By maintaining the liquid condensed phase (i.e., it has not undergone thermolysis and/or dehydrogenation to form mature soot, fullerenes or nanotubes), the liquid phase can be used to form the desired products.

Because Benish fails to teach or suggest all of the limitations of claims 1, 46 and 49, it is believed that claims 1, 46 and 49 (and claims 2-28, 34-42, 44, 47-48 and 50-52 that depend thereon) are patentable over Benish.

Rejection under 35 USC §102(e) or 35 USC §103(a)

Claims 1-28, 34-42, 44 and 46-52 were rejected under 35 USC §102(e) or 35 USC §103(a) over U.S. Patent No. 5,985,232 to Howard et al. ("Howard"). The Office Action states that Howard teaches forming a combustion flame and collecting polyatomic [*sic* polyaromatic] hydrocarbon condensibles from a liquid.

Amended independent claims 1, 46 and 49 now recite that at least a portion of a condensed phase comprising a liquid phase is collected from the flame. This amendment serves to more clearly distinguish the claimed invention from Howard.

In the process of Howard, an unsaturated hydrocarbon fuel and oxygen are combusted in a non-arc-discharge burner chamber to establish a flame, and condensibles of the flame are collected at a post-flame location. Throughout Howard, it is disclosed that the condensibles of the flame are collected at a post-flame location. (See page 2, lines 26-28; page 2, lines 41-42; page 3, lines 5-8; page 3, lines 19-21; and page 3, lines 24-26 of Howard). Furthermore, the process by which Howard collects condensibles of the flame is described at column 7, lines 41-54 wherein it is stated:

> Samples of soot and condensibles were collected at a given "post-flame" distance from the burner. Post-flame collection sites included two and seven centimeters "down stream" from the burner, as measured perpendicular from the burner surface to the orifice at the tip of the sampling probe. Vapor collection and quenching was accomplished by inserting a water-cooled quartz probe connected to a filter, vacuum pump, and gas meter into the flame vapor stream, rapidly withdrawing and cooling the vapors and collecting the condensate ("condensibles") on the in-line filter. Sample of condensibles were also collected from the water-cooled top surface of the combustion chamber against which the flame tail impinged.

Thus, the condensibles of the Howard process are being collected by way of the physical condensation of the flame vapor stream, typically by use of a cooled probe.

In contrast, the invention recited in claims 1, 46 and 49 includes the step of collecting from the flame at least a portion of a condensed phase comprising a liquid phase. Thus, there is a significant difference between the present invention and the Howard process. Specifically, the Howard process is relying on physical condensation

of a vapor to collect condensibles. In the present invention, chemical condensation in the flame forms a condensed phase and this condensed phase is thereafter collected from the flame. Claims 1, 46 and 49 make it clear that the carbon-containing material is condensed in the flame before collection of the condensed phase from the flame.

Because of the differences in the collection processes of the present invention and Howard, different materials are collected in the processes. By condensing the flame vapor stream at a downstream location, the Howard process will collect mature soot, fullerenes, nanotubes and gas phase condensed hydrocarbons. In contrast, the method of the present invention collects from a flame a condensed phase comprising at least one polycyclic aromatic hydrocarbon that may be used to form fullerenes and nanotubes in subsequent steps.

In addition, the precursor soot produced in Howard's flame is converted into mature soot before it exits the flame. The fullerenes that Howard sees likely derive from the gas phase and during the carbonization of precursor soot. The fullerenes produced in Howard's flame represent only a couple of percent of the product. Most of the product is mature black soot. In contrast, the present invention serves to thwart the production of mature soot and collect primarily precursor soot and use that as a reactive medium to produce fullerenes by subsequent manipulation after the flame. Thus, further differences in Howard's process and the present invention are evident.

Because Howard fails to teach or suggest all of the limitations of claims 1, 46 and 49, it is believed that claims 1, 46 and 49 (and claims 2-28, 34-42, 44, 47-48 and 50-52 that depend thereon) are patentable over U.S. Patent No. 5,985,232 to Howard et al.

Conclusion

It is respectfully submitted that the entire application has been placed in condition for allowance. Favorable reconsideration is respectfully requested. A fee sheet is attached for the extension request. No other fees are believed to be needed for this amendment. If other fees are needed, please charge them to Deposit Account 17-0055.

Respectfully submitted,
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By: _____

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